Contents

Title	Page No.
Contents	i
Acronyms	iv
List of Figures	vi
List of Tables	xiii
Chapter 1: Introduction	1
1.1 Research Problem and the Objectives	3
1.1.1 The Objectives of the Research Work	3
Chapter 2: Review of Literature	5
2.1 Surface Mining Activities	5
2.1.1 Drilling	7
2.1.2 Blasting	8
2.1.3 Loading and unloading of material	8
2.1.4 Haul Road and Transportation of material	9
2.1.5 Crushing and Storage of the material or overburden	9
2.1.6 Solid Waste Handling and Re-handling	10
2.2 Particulate matter and its residence time	10
2.2.1 Residence time of particulate matter	11
2.2.2 Effects of particulate matter	11
2.2.3 Regulations pertaining to particulate matter	14
2.3 Field Studies of Dust Management at Surface Mine	16
Operations	
2.3.1 Field Studies on the characterisation of dust from	16
the mining activities	
2.3.2 Field Studies on quantification of the dust and	18
development of emission factor of the mining activities	
2.3.3 Field Studies on the impact on environment and	21
health from mining activities	
2.3.4 Field Studies on the dust emission from the haul	22
road	
2.3.5 Field Studies on the dust emission from the	24
overburden dump	
2.3.6 Field Studies for the development of a model and	25
its validation on dust dispersion	
2.3.7 Field Studies on dispersion modelling from	29
computational fluid dynamics	
2.4 Dust Dispersion Models used in Mining Industry	32
2.4.1 Basic Mathematical Models	32
2.4.1.1 Box Model Algorithm	33
2.4.1.2 Gaussian Model Algorithm	33
2.4.1.3 Eulerian Model Algorithm	34
2.4.1.4 Lagrangian Model Algorithm	34
2.4.2 Surface Mine Models	35
2.4.2.1 Pit Retention Model	35
2.4.2.2 Stockpile Emission Model	36

2.4.2.3 ISC3 Model	37
2.4.2.4 Dynamic Component Model	39
2 4 2 5 ADMS Model	40
2.4.2.6 AEPMOD Model	40 12
Charter 2: Simulation and Validation	42
Chapter 3: Simulation and Validation	40
3.1 AERMOD modelling system	40
3.2 Simulation procedure for a mine to predict dust dispersal	47
3.3 Simulation of an opencast coal mine 'A' to predict dust dispersal	48
3.3.1 Description of Mine 'A' Opencast Coal Project	49
3.3.2 Dust Sources and their location	51
3.3.3 Determination of source strength of dust sources	52
3.3.4 Location of receptors	54
3.3.5 Meteorological parameters for Mine 'A' area	56
3.3.5.1 Surface meteorological parameters	56
3.3.5.2 Upper air meteorological parameters	57
3.3.6 Development of Digital Elevation Model (DEM)	60
3.4 Prediction of concentration of PM_{10} using AERMOD at	62
receptors	
3.5. Measurement of concentration of PM_{10} at different locations	97
(receptors) of High Volume Samplers	00
3.6 Validation of simulation model of a coal mine	99
3.6.1 Statistical parameters used for the validation study	99
3.6.2 Model Performance Evaluation using Statistical	102
Parameters	
Chapter 4: Simulation of mining system of varying depth	113
4.1 Simulation of mining system	113
4.2 Simulation Process	122
4.2.1 Simulation of a mine at varying depth	122
4.2.2 Simulation of internal overburden dump with	122
4.2.2 Simulation of haul road with verying depth	121
4.2.5 Simulation of hauf toda with varying deput	124
4.3 Environmental conditions used for modelling	125
Chapter 5: Results and Discussions	129
5.1 Dust dispersion with varying depth and wind direction	129
5.1.1 Dust dispersion with varying depth and easterly	129
wind	
5.1.2 Dust dispersion with varying depth and westerly wind	135
5.1.3 Dust dispersion with varying depth and southerly	140
wind	1 47
5.2 Dust dispersion due to internal overburden dump with varying depth and wind direction	147

5.2.1 Dust dispersion due to internal overburden dump	147
with varying depth and easterly wind	
5.2.2 Dust dispersion due to internal overburden dump	153
with varying depth and westerly wind	
5.2.3 Dust dispersion due to internal overburden dump	159
with varying depth and southerly wind	
5.3 Dust dispersion due to haul road with varying depth and wind	167
direction	
5.3.1 Dust dispersion due to haul road with varying	167
depth and easterly wind	
5.3.2 Dust dispersion due to haul road with varying	173
depth and westerly wind	
5.3.3 Dust dispersion due to haul road with varying	180
depth and southerly wind	
Chapter 6: Conclusions and Suggestions for future work	187
References	189
Appendix I	<i>19</i> 8
Appendix II	199
List of publications	284